

Article

Fungicidal seed treatment on germination and seedling vigour of lentil var. BINA Masur-3

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Abstract: Effectiveness of six fungicides viz., Provax-200 (Carboxin+Thiram), Bavistin DF (Carbendazim), Dithane M-45 (Mancozeb), Secure (Mancozeb+Fenamidone), Antracol (propineb) and Daconil (Chlorothalonil) were evaluated to improve seed germination and seedling vigour of lentil variety BINA Masur-3. The experiment was conducted in the Green House of Seed Pathology Centre, Bangladesh Agricultural University, Mymensingh. Positive effect of seed treatment with fungicides on seed germination and seedling vigour of lentil was recorded. At 20 DAS, increased seed germination over control was observed in treated seeds with Deconil (10.40%) and Antracol (10.00%) followed by Dithane M-45 (7.20%). Seeds treated with Deconil and Dithane M-45 produced seedlings with higher shoot length, root length and seedling vigour. At 20 DAS, higher percent increased vigour index over control was found in Dithane M-45 (24.64%) and Deconil (22.44%), respectively.

Keywords: seed germination; seedling vigour; lentil; fungicide; Daconil

1. Introduction

Lentil is a leading pulse in many developing countries including Bangladesh. It can play an important role in fighting hunger and malnutrition and in improving agricultural sustainability. It is highly rich in protein (Erskine and Witcombe, 1984) and a rich source of several essential micronutrients (Fe, Zn, b-carotene) (Bhatty, 1988). In Bangladesh, lentil is cultivated in an area of about 97400 ha with total production of about 1.57 lac ton (2% of global share) having an average yield of 1.26 ton/ha (BBS, 2016), whereas average yield of the leading pulse producing countries like Canada, India, Australia, Turkey and The United States was 1.63, 1.61, 1.47, 1.42 and 1.49 ton/ha, respectively (FAOSTAT, 2016). The low productivity of lentil in Bangladesh is attributed by many production constraints. Among these, biotic factors particularly diseases play a major role in limiting the yield of lentil. A number of phytopathogenic soil borne as well as seed borne fungi are responsible for disease development which attack plants during seedling to maturity stages and are more destructive at seedling stage (Hoque, 2014).

Every seed is a potential harbor of a wide variety of mycoflora containing both pathogenic and saprophytic microorganisms, both externally and internally (Utobo *et al.*, 2011). These mycoflora deteriorate seed quality, affect viability and reduce germination of seeds, resulting in the production of abnormal seedlings (Islam and Monjil, 2016; Khanzada *et al.*, 2002). The use of effective seed treatments can reduce the severity of these seed borne pathogens. Fungicidal seed treatments control fungi residing on the seed surface or inside the seed and are also effective against pathogens that reside in soil causing seedling diseases. Fungicidal seed treatment controls seed-borne diseases, improves plant stand, seedling vigour and crop yield (Tanweer, 1982; Shah and Jain, 1993; Klich *et al.*, 1994). To increase the production of lentil qualitatively and quantitatively farmer requires quality seeds. Hence, the present investigation was conducted to find out the effect of recently introduced fungicides on seed germination and seedling vigour of lentil.

2. Materials and Methods

Seeds of BINA Masur-3 were collected from BINA Regional Research Station, Pabna, Bangladesh during August 2016. Six fungicides viz., Provax-200 (Carboxin+Thiram), Bavistin DF (Carbendazim), Dithane M-45 (Mancozeb), Secure (Mancozeb+Fenamidone), Antracol (propineb) and Daconil (Chlorothalonil) were collected from authorized agrochemical shops in Mymensingh.

Required amount of seeds and fungicide were taken in a conical flask. Then, few drops of sterilized water were added and shaken well with hands for few minutes and then kept open for drying. When the seeds appeared coating with fungicides then 50 seeds were sown in each tray for germination and vigour test.

Germination test was carried out according to ISTA (2003). Plastic trays (20 cm x 25 cm) were used for this test. The trays were filled with moist sand at field capacity. Eight trays were used for each treatment (fungicide). Fifty seeds were sown in each tray. At 5, 10, 15 and 20 days after sowing, data on germination, shoot length and root length were recorded. At that time ten seedlings for each treatment were randomly selected, and shoot and root length were measured. Vigor index was determined by the following formula given by Baki and Anderson (1972).

Collected data were statistically analyzed using MSTAT-C Computer Package Program. The significance of the difference among the treatments means was estimated by the least significant difference (LSD) test at 5% level of probability (Gomez and Gomez, 1984).

3. Results

3.1. Efficacy of fungicides on germination of lentil seeds

Lentil seeds treated with fungicides showed significant increase of seed germination in tray soil at 5, 10, 15 and 20 DAS (Table 1). Highest seed germination at 5DAS was observed in seeds treated with Antracol (83.67%) followed by Secure (83.00%) and Dithane M-45 (82.67%). At 10 and 15 DAS, highest germination was observed when seeds were treated with Antracol followed by Dithane M-45. At 20 DAS, highest seed germination was observed when seeds were treated with Daconil (92.00%) and Antracol (91.67) which are statistically similar followed by Dithane M-45 (89.33%). Lowest germination was recorded in control treatment. At 20 DAS, Daconil resulted highest seed germination over control (10.40%) followed by Antracol (10.00%) and Dithane M-45 (7.20%). Seed treatment with Bavistin DF (carbendazim) did not exert good response in increasing seed germination of lentil.

Table 1. Efficacy of fungicides on germination (%) of lentil var. BINA Masur-3.

Treatments	Germination (%)				Percent increase germination over control at 20 DAS
	5DAS	10DAS	15DAS	20DAS	
Provax-200	70.00 bc	77.00 b	83.00 b	85.67 ab	2.80
Bavistin DF	63.33 c	70.00 c	78.67 c	84.00 ab	0.80
Dithane M-45	82.67 a	86.00 a	87.33 ab	89.33 ab	7.20
Secure	83.00 a	85.00 a	87.00 ab	86.33 ab	3.60
Antracol	83.67 a	88.33 a	89.67 a	91.67 a	10.00
Deconil	72.67 b	77.00 b	86.00 ab	92.00 a	10.40
Control	62.67 c	69.00 c	78.00 c	83.33 ab	-
Level of significance	**	**	**	**	

Data were subjected to Duncan's Multiple Range Test (DMRT) using a statistical computer package (MState C). Each value represents the mean and standard deviation of three replications. In a column, figures with same letter or without letter do not differ significantly whereas figures with dissimilar letter differ significantly (as per DMRT). *P < 0.05, *P < 0.01 versus control treatment.

3.2. Efficacy of fungicides on shoot length, root length and seedling vigour of lentil

Efficacy of fungicides on shoot length, root length and seedling vigour of lentil was evaluated at 5, 10, 15 and 20 DAS where significant variation was observed among the different treatments (Table 2, 3 & 4). Fungicidal treatments showed little effect on shoot length up to 20 DAS. Reduced shoot length was observed in seedlings treated with Bavistin DF. At 20 DAS, Bavistin DF and Provax-200 treated seedlings produced significantly lower shoot length. In case of root length, highest root length was found when seeds were treated with Daconil followed by Provax-200 and Secure at 5 DAS. At 10, 15 and 20 DAS, seeds treated with Dithane M-45 produced higher root length. Bavistin DF decreased the root length of lentil seedlings.

At 5, 10, 15 and 20 DAS, higher seedling vigour as vigour index was observed by Dithane M-45 and Daconil (Table 4). At 20 DAS, vigour index of lentil ranged from 2242.36-2799.12. Highest Vigour Index was recorded in case of using Dithane M-45 (2799.12) followed by Daconil (2745.54), Antracol (2529.5) and Secure

(2501.79), while lowest seedling Vigour Index (2242.36) was found in case of control preceded by Bavistin DF. At 20 DAS, highest increased Vigour Index over control was found in Dithane M-45 (24.83%) followed by Daconil (22.44%). Lowest percent Vigour Index increased over control was observed by Bavistin DF (2.64%).

Table 2. Efficacy of fungicides on shoot length (cm) of lentil var. BINA Masur-3.

Treatments	Shoot length (cm)			
	5DAS	10DAS	15DAS	20DAS
Provax-200	6.70 a	10.26 a	11.63 bc	12.06 c
Bavistin DF	5.41 c	8.597 b	11.36 c	12.22 bc
Dithane M-45	5.99 bc	10.09 a	12.60 a	13.52 a
Secure	5.92 bc	9.913 a	12.16 abc	13.74 a
Antracol	6.75 a	10.40 a	12.25 ab	13.24 ab
Deconil	6.00 bc	9.823 a	11.49 bc	13.32 ab
Control	6.32 ab	10.05 a	12.01 abc	13.49 a
Level of significance	**	**	*	*

Data were subjected to Duncan's Multiple Range Test (DMRT) using a statistical computer package (MState C). Each value represents the mean and standard deviation of three replications. In a column, figures with same letter or without letter do not differ significantly whereas figures with dissimilar letter differ significantly (as per DMRT). *P < 0.05, *P < 0.01 versus control treatment.

Table 3. Efficacy of fungicides on root length (cm) of lentil var. BINA Masur-3.

Treatments	Root length (cm)			
	5DAS	10DAS	15DAS	20DAS
Provax-200	10.05 b	11.19 b	14.87 ab	16.04 b
Bavistin DF	8.00 d	9.99 cd	12.27 e	15.18 bc
Dithane M-45	8.05 d	14.07 a	15.53 a	17.77 a
Secure	9.55 b	10.78 bc	13.73 bcd	15.25 bc
Antracol	8.74 c	10.59 bc	13.11 cde	14.33 cd
Deconil	10.81 a	10.91 bc	14.25 abc	16.51 ab
Control	8.21 cd	9.31 d	12.54 de	13.39 d
Level of significance	**	**	**	**

Data were subjected to Duncan's Multiple Range Test (DMRT) using a statistical computer package (MState C). Each value represents the mean and standard deviation of three replications. In a column, figures with same letter or without letter do not differ significantly whereas figures with dissimilar letter differ significantly (as per DMRT). *P < 0.05, *P < 0.01 versus control treatment.

Table 4. Efficacy of fungicides on Vigour Index of lentil var. BINA Masur-3.

Treatments	Vigour Index				Percent increased Vigour Index over control at 20 DAS
	5DAS	10DAS	15DAS	20DAS	
Provax-200	1170.14 a	1650.72 cd	2201.21 b	2401.87 c	7.11
Bavistin DF	849.26 b	1302 e	1858.97c	2301.6 c	2.64
Dithane M-45	1160.29 a	2080.37 a	2457.75 a	2799.12 a	24.83
Secure	1284.43 a	1759.90 bc	2255.37 b	2501.79 bc	11.57
Antracol	1294.58 a	1853.42 b	2274.52 b	2529.9 abc	12.82
Deconil	1225.27 a	1597.67 d	2212.23 b	2745.54 ab	22.44
Control	911.30 b	1338.77 e	1915.50 c	2242.36 c	-
Level of significance	**	**	**	**	

Data were subjected to Duncan's Multiple Range Test (DMRT) using a statistical computer package (MState C). Each value represents the mean and standard deviation of three replications. In a column, figures with same letter or without letter do not differ significantly whereas figures with dissimilar letter differ significantly (as per DMRT). *P < 0.05, *P < 0.01 versus control treatment.

4. Discussion

Lentil seeds treated with fungicides showed significant increase of germination at 5, 10, 15 and 20 DAS. At 5, 10 and 15 DAS, highest germination was observed in seeds treated with Antracol followed either by Dithane M-45 or Deconil or vice-versa. At 20 DAS, Deconil resulted highest seed germination over control (10.40%) followed by Antracol and Dithane M-45. Bavistin DF (carbendazim) showed little response in increasing seed germination of lentil. Jayale *et al.* (2015) reported that Antracol, Mancozeb and Daconil increased seed germination of chick pea under pot culture condition. Rahman *et al.* (2012) noted that Maximum germination (85.53%) of cowpea was achieved when seeds were treated with Provax-200 @ 0.25 % followed by Bavistin 50 WP @ 0.25 %. Morshed *et al.* (2014) found increased germination of chickpea by treating seeds with secure 600WG (48.62%) followed by provax-200WP (44.38%) over control. Andrabi *et al.* (2011) found that Seed treatment with Carbendazim increased seed germination (71.24%) in chickpea, though it was at par with Carbendazim + Mancozeb (62.21%) and Mancozeb (61.46%). Matus and Slinkard (1993) found that Vitaflo 280 (Vitavax + Thiram) increased seedling emergence (23%) of field pea as compared to the untreated control. Hoque *et al.* (2012) reported enhanced germination (%) of lentil was in Secure 600wg (0.2%) treated seeds. Islam *et al.* (2005) reported that Vitavax-200 is most effective at the lowest concentration in increasing germination of lentil seeds. However, there is no information available in most journals in Bangladesh and online sources regarding the performance of Antracol and Daeconil on germination in lentil. Therefore, seed treatment with Antracol, Dithane M-45 and Daconil might be useful in increasing germination of lentil seed significantly. Antracol or Daconil can be used as a good substitute of commonly known seed treating chemicals like Provax-200, Bavistin DF, Dithane M-45, and Secure.

Efficacy of different fungicides on shoot length, root length and seedling vigour of lentil under green house condition was evaluated and highest shoot length was obtained when seeds were treated with Secure followed by Dithane M-45. Highest root length was obtained when seeds were treated with Dithane M-45 followed by Daconil. Morshed *et al.* (2014) reported that maximum shoot length (11.78%) of chickpea was found when seeds were treated with Secure 600WG, while maximum root length (21.80%) was recorded when seeds were treated with Provax 200WP over control. Alrajhi (2014) reported that root length and shoot length of maize was increased with increasing concentrations of Dithane M-45.

In respect of seedling vigor test of lentil seeds a wide range of variation was found significantly. Maximum vigor index was observed in Dithane M-45 followed by Daconil and minimum was recorded in untreated control. Present findings are in accordance with the observation of Alrajhi (2014), who published that the increase in vigor index was significant at different concentration of Dithane M-45 fungicides as compared to control. Doyle *et al.* (2001) also reported similar findings that seedlings treated with thiamethoxam had a particular advantage of improved seedling vigor

It is noticeable that Bavistin DF (Carbendazim) and untreated control resulted almost similar shoot length, root length and seedling Vigour Index. Ineffectiveness of carbendazim on Vigour Index of lentil might be due to its suppressive effect. Windham and Windham (2004) indicated that systemic fungicides which are based on sterol biosynthesis inhibitor are closely related to plant growth regulators, the use of which at higher than labeled rates shorten the internodes which may lead to slow shoot growth.

5. Conclusions

It can be concluded that there is positive effect of seed treatment with fungicides on seed germination and Vigour Index of lentil. Seed treatments with Antracol (Propineb), Daconil (Chlorothalonil), Dithane M-45 and Secure (Mancozeb+Fenamidone) resulted better germination and seedling Vigour Index of lentil over control.

Conflict of interest

None to declare.

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